Recycler as an Accumulator & 1 sec MI Cycle

♦ 1 sec cycle was studied in PD2 but rejected due to high cost.

♦ But termination of BTeV means Recycler can be a proton accumulator after 2009, making 1 sec cycle a viable option.

	Intensity	Cycle time	Protons per hour	Protons per year
Baseline	3e13	1.867 s	5.8e16	2.8e20
Slip/barrier stacking (in MI)	6e13	2.267 s	9.5e16	4.6e20
Proton driver	15e13	1.5 s	3.6e17	17e20
Present intensity	3e13	1 s	1.1e17	5.2e20
Slip/barrier stacking (in RR?)	6e13	1 s	2.2e17	10e20
Proton driver	15e13	1 s	5.4e17	26e20

(J. Cooper: 1 year = 120 hours/wk x 40 weeks = 4,800 hours)

Max pdot = 260 GeV/s
(D. Wolff: Doable by present power supply)

Momentum in a NuMI Cycle (1.533 sec)
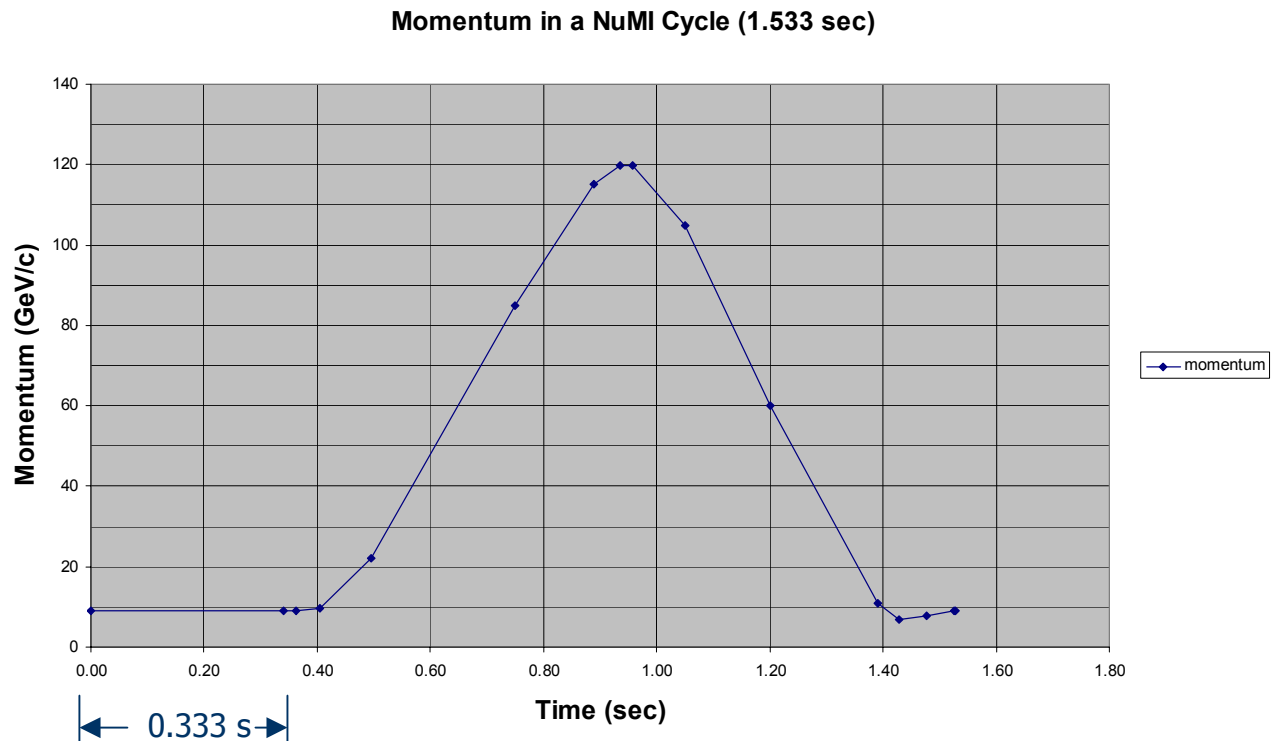
1.533 − 0.333 = 1.2 s ⇒ Need to chop another 0.2 s

MI RF Power Calculation

- Cavity Q = 3000 (at max ramp rate), R/Q = 104 Ω, R = 3.1×10^5 Ω
- **17 cavities**, each delivering **175 kW** (max 200 kW) for a **total of 3.0 MW**
- **Wall/tuner loss:** V(gap) = 240 kV $\Rightarrow$ P = **92 kW each, total of 1.57 MW** for 17 cavities
- Beam intensity: 3.3×10^{13}, 4.0×10^{13} and 6.0×10^{13}

Max ramp rate (GeV/s)	Beam intensity	Power to the beam (MW)	Wall/tuner loss (MW)	Total power (MW)
240	3.3×10^{13}	1.27	1.57	2.84 (o.k.)
240	4.0×10^{13}	1.54	1.57	3.11
240	6.0×10^{13}	2.30	1.57	3.87
280	3.3×10^{13}	1.48	1.57	3.05
280	4.0×10^{13}	1.79	1.57	3.36
280	6.0×10^{13}	2.69	1.57	4.26

Need 2nd PA for either higher beam intensity or fast ramp

Issues

- Recycler
  - MI-8 to RR beam line (Johnstone)
  - RF (need new barrier rf)
  - Instabilities (Pruss: so far ok with finite chromaticities)
  - Shielding (Kostin)
  - BPM (Pruss)
  - Abort kicker (Pruss)
  - Radiation hardness of permanent magnet (Pruss: non-issue)
  - Can we do slip or barrier stacking in RR? (barrier stacking easier)
- 1 sec cycle in MI
  - RF (need more calculations)
  - Power supply (Wolff: max pdot 325 GeV/s)
  - Magnet (Harding: non-issue)